CENTRAL BANK INDEPENDENCE: TAYLOR RULE AND FISCAL POLICY

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Abstract:

In this article we will show that independence is not enough to impose a given inflation target when the Central Bank is following a Taylor rule, moreover in such a case, the fiscal authority will be able to set a different objective from the one sought by the monetary authority. On the other hand, if the fiscal authority is acting in accordance with a rule in which there is a estimated equilibrium expenditure G* similar to the estimated real interest rate r* in the Taylor rule, neither the government will be able to establish its inflation target value. In this sense, the type of rule that the economic authorities implement is essential for stabilization purposes. The different periods of implementation in fiscal and monetary policy are taken into account although they did not change the main conclusions.

Scheme

1. –Introduction

It is widely recognized that an independent Central Bank is the first requirement to meet the goal of low and stable inflation. However, in this article we will show that independence is not enough to impose a given inflation target when the Central Bank is following a Taylor rule, moreover in such a case, the fiscal authority will be able to set a different objective from the one sought by the monetary authority.

Kydland and Prescott (1977) initiated a debate that was followed by Barro and Gordon (1983a) who stated the inflationary bias problem which arises from a

discretionary monetary policy (not subject to any rules) that gives incentives to create inflation in order to obtain other desirable objectives. In this framework, commitment to a monetary policy rule could establish the necessary limits to correct this inflation bias. In a recent work Clarida, Galí and Gertler (1999) showed that a credible commitment to a monetary policy rule could reduce the expected inflation even when there is no gain in terms of other targets Another possible solution to the inflation bias, next to reputation building proposed by Barro and Gordon (1983b), could be the delegation of monetary policy to an independent Central Bank put forward by Rogoff (1985) and a rapidly expanding literature[1]. In the Rogoff model, the inflation bias is reduced thanks to the delegation of the monetary power to a conservative central banker relatively more averse to inflation than the representative government.

However, price stability is not only a monetary policy concern but it is the result of a fiscal and monetary policy mix, although nearly all the previously mentioned studies ignore the behaviour of fiscal policy. In this sense, subsequent research depart from the design of monetary institutions to draw attention to the interaction between fiscal and monetary authorities. In relation to the problem of interaction between policies we could differentiate two views: on the one hand, the literature who deals with the problem of strategic interaction. A precedent is the paper of Blinder (1983) in which he considers fiscal and monetary policy as having different objectives in output and inflation. Dixit and Lambertini (2001) in a game theory framework argue that although they could have the same objectives, the weight fiscal and monetary authorities attribute to final targets in terms of output and inflation differs in such a way that a race between both authorities could lead to equilibrium levels far away from the targets, concluding that the coordination in targets between both authorities is essential. In the Monetary Union context, in a different game theory setting, Buti et al. (2001) argue that the substitutability or complementarity between fiscal and monetary policies in obtaining the desirable targets depends on the shocks hitting the economy. On the other hand, some studies deal with the issue of coordination from a different perspective Taylor (2000) indicates that countercyclical fiscal policy should focus on the automatic stabilizers rather than discretionary actions, because the latest could make monetary policy-making more difficult. Canzoneri (2002), in the same line, considers that since the delays in the legislative process hinder the possibility of strategic interaction, it is necessary to decompose fiscal policy in the discretionary and

[1] Other authors interested in the design of appropriate monetary institutions to obtain inflation targets are Fischer (1995), Lohmann (1992), Persson and Tabellini (1994), Waller and Walsh (1996),Walsh (1995), Svensson (1997).

the nondiscretionary components. The discretionary component is treated as a shock that monetary policy has to face, in the line of Blanchard and Perotti (2001) or Fatas and Mihov (2000). In relation with the nondiscretionary component, the automatic stabilizers, Canzoneri argues that it may not be necessary to impose a fiscal constraint in order to keep price stability.

From a different perspective, some authors have attempted to clarify the effects of the actions of both authorities on the stability of the price level. The recent work known as the fiscal theory of price level (FTPL) initiated with Woodford (1995, 2001a) and extended by Canzoneri *et al*. (1998), Cochrane (1998), Schmitt-Grohe and Uribe (2001a, 2001b), Leeper (1991), Leith and Wren-Lewis (2000), Sims (1994) tend to establish the conditions under which either fiscal or monetary policy alone determine the price level[2]. The FTPL states that if government solvency is not guaranteed, monetary policy will not be able to control the price level given that even if monetary policy is consistent with a low implicit inflation target, keeping it tied by a Taylor rule or by a conservative central banker, the inconsistency of fiscal policies could lead to an inflation spiral. In this sense, in order to ensure stability, in the event of inflationary pressures, when interest rate rises, fiscal authorities should increase primary surplus. Thus, a monetary commitment to a low inflation target is not enough and must be accompanied by a fiscal commitment in relation to the fiscal solvency.

In our study we try to move a step further and to determine the requirements for a policy rule to stabilize the price level at a given target. The main contribution of this paper consists of analysing the paramount importance of the interaction between fiscal and monetary policy in terms of rules which surprisingly have not received enough attention. Ballabriga and Martínez-Mongay (2002) deal with the subject although they focus on the behaviour of fiscal and monetary policy rules before and after the European Monetary Union. Benigno and Woodford (2003) derive policy rules that the monetary and fiscal authorities could follow in order to implement the optimal equilibrium targets. However, this first paper lacks a deep study of the effects of the interaction between both types of rules in a more general framework, and the second one is very dependent on the optimization model proposed. This paper intends to cover this gap. It is organized as follows. After an introduction, section 2 reviews briefly the existing literature for fiscal and monetary rules. Section 3 presents the problems of a Taylor rule type and describe its implications in relation to the inflation target. Section 4

contains some simulations to illustrate the previous results. Finally, section 6 include some concluding remarks and possible extensions.

2. -The design of fiscal and monetary policy rules

We could define a policy rule as a constraint that is imposed on the behaviour of the economic authorities, either because it is considered that there exists a bias that could prevent from reaching the targets or simply because a feedback rule, that automatically stabilizes the economy, could be the best instrument, in terms of welfare, that is to say the faster and more appropriate one, to face the shocks that affect the economy. The policy rules might be classified in relation to their degree of stringency, therefore, there will be a broad ranking of possibilities from the simplest and narrowest rule, that could imply the fixation of the level or the rate of growth of the instrument or the target as such, to the most extensive one which will be close to complete discretion in the hands of the authority.

Monetary policy rules caught earlier the attention of the literature. Friedman (1959) establishes the well-known fixed money growth rate requirement for stabilization. After that, a considerable debate focus on the relevance of following a rule obtained from an optimization procedure rather than discretion, based on the time inconsistency problem. However, until Taylor (1993) not much research raises the issue of the appropriateness of rule design. In an empirical work, Taylor (1993) examined the performance of several monetary rules in a multicountry rational expectations model, according to how successful they were in achieving price and output stability, as a conclusion he came up with the following result:

$$r_t = r^* + \alpha_1((Y_t - Y_n)/ Y_n) + \alpha_2(\Pi_{t-1} - \Pi_o)$$

Where,

r_t is the real interest rate;
r^* is the assumed equilibrium real interest rate. Although Taylor does not give a definition, we consider as such the one that does not accelerate inflation because it assures that the current GDP Y_t is equal to the trend or potential one, Y_n, expressed as a percentage of potential output;

[2] The FTPL is criticised by Buiter (2001) who argues the existence of fundamental economic

Π_{t-1} is the inflation rate of the previous period

Π_o is the inflation target;

α_1 is the coefficient that measures the size of the required reaction of the monetary authority to the output gap in order to stabilize the economy;

α_2 is the same coefficient in relation to the difference between the inflation of the previous period and the target. In other words, α_1 and α_2 are the parameters that indicate how strong is the monetary policy response.

This coefficients were calibrated by Taylor as follows:

α_1=0,5; α_2=1,5; r*=2; Π_o=2

In this context, he showed that, for the period 1987-1992, the rule could explain the behaviour of the Federal Reserve reasonably well, which has been reinforced by subsequent simulations. Moreover, even though it was a very simple rule, it was found to have performed as well as optimal forecast-based reaction functions and the results appear to be fairly robust across a variety of macroeconomic models[3]. Clarida, Galí and Gertler (1998) confirm the empirical relevance of the rule extending it to a forward-looking model for a set of major economies. On the other hand, some authors have obtained optimal monetary policy rules from an optimization process[4]. However as we have already argued, these optimal rules are very dependent on the setting and the non-optimization ones do not have to show a worse performance in stabilizating the economy and sometimes the result of optimization settings and the non-optimization rules might even share some features[5].

The research in relation to fiscal rules has been developed more recently. In general, the fiscal components used to appear in the macroeconomic model in an exogenous way, or occasionally the fiscal rule was calibrated for empirical purposes without paying much attention to the design of a general rule that could help to stabilize the economy. One of the main difficulties in finding general fiscal rules is that neither the instrument to be used (revenues, expenditure, surplus, debt, etc) nor the target (inflation, output gap, sustainability of public finances, debt, etc) had found much consensus in the literature contrary to the monetary policy case. On the other hand,

misspecification.

[3] See Judd and Rudebusch, ()

[4] See, Clarida, Galí, Gertler (1999)

[5] See Woodford (2001b)

deriving optimal fiscal policy rules involved a Ramsey-type of government that reduced the analysis to very simple economies.

Ballabriga and Martínez-Mongay (2002) characterized the behaviour of fiscal and monetary authorities estimating forward-looking fiscal and monetary policy rules. They obtain that the regimes of both, the pre-EMU and the post-EMU periods, were monetary dominance regimes -what means an active monetary policy that control the inflation and a passive fiscal one-. Benigno and Woodford (2003) obtain, from an optimization setting, fiscal and monetary policy rules however, they did not discuss the effects of the rules in achieving the equilibrium targets. Our proposal in designing policy rules goes in line with Taylor (1993) in the sense that, we will propose a backward-looking rule, since it simplifies the background without resting any significant relevance to the point we want to establish, that is the importance of the fiscal policy rule followed in order to achieve an inflation target. However, we will show that our rule improves the Taylor proposal given that it leads the economy to the inflation target, what is not always the case with the Taylor one. We also consider that a specification of the rules, outside of a optimization setting as in Ballabriga and Martínez-Mongay (2002) is more general since it is less model depending and in that sense more appropriate for our policy discussion. In an interesting article, Buiter (2003) analyses the characteristics that fiscal rules in a monetary union should fulfil[6].

In order to analyse the working of the proposed policy rules, we will model a very simple consumption economy. The demand will be expressed by an IS equation

$$Y_t = a - br_t + G_t \qquad (1)$$

Where,

Y_t is the real output; a and b are parameters, and G_t is the government expenditure.

The second important component of our analysis is the equation that describe the inflation mechanism. We consider in line with Blanchard that inflation is the result of a current production higher than the trend or potential production[7]. Thus,

$$(\Pi_t - \Pi_{t-1}) = \beta(Y_t - Y_n) \qquad (2)$$

[6] For a detail study of the permanent-balance rule see Buiter and Grafe (2002)

where,

β is the parameter that measures the influence of the output gap in inflation.

In the above setting we propose two types of rules. On the one hand, a monetary rule

$$r=r_{t-1}+\alpha(\Pi_{t-1}-\Pi_o) \quad (3)$$

where,

α is the parameter that measures the strength with which the Central Bank applies its policy.

This rule differs from the Taylor type of rule in two ways: first, we do not include any policy target in relation to the output gap because we consider it superfluous, given that if an stable inflation path is achieved, this will also guarantee that the adequate proximity between current and potential GDP is maintained. Second, one of the most criticised feature of the Taylor rule is the equilibrium real interest rate r*. It is nearly impossible to know the real r* in an accurate way, because even in the case one could know it, according to the Lucas critique when a shock hits the economy, the equilibrium real interest rate r* will change to a new r^*_2, that will be different depending on the shock, and then, the old r* will not be able to stabilize the economy. Moreover, the introduction of a fix r* in the rule will deprive it from any inertia in relation with the previous policies, what is not too realistic and introduces additional difficulties in order to stabilized the economy. In this sense, we use the real interest rate of the previous period as the one that the monetary authority will modify depending on the needs, increasing it when inflation is above the target or decreasing it in the opposite case.

On the other hand, we propose the following fiscal rule, analogous to the monetary one

$$G_t=G_{t-1}-\gamma(\Pi_{t-1}-\Pi_o) \quad (4)$$

[7] Blanchard, O. (2003)

Where,

γ is the coefficient that sizes the intensity with which the fiscal authority modifies the expenditure to reduce inflation.

We do not deal with the appropriateness of the fiscal instrument chosen because it escapes the purpose of this paper and it will not introduce any significant modification to our conclusions. Thus, the fiscal instrument to stabilize the economy will be the previous period public expenditure and the government will decrease or increase it every period depending on the difference between the previous period inflation and the target.

3.-The Taylor type of rule and the inflation target

We will show that in the previous setting, the type of rule that the economic authority follows will be crucial to reach the objectives. For stabilization purposes, we refer to the achievement of the inflation target, because as we point out before, if the inflation target is reached it implies the stabilization of the output gap at the same time, as equation (2) shows.

Let's analyse the working of an economy characterized by equations (1) and (2), a Central Bank acting according to a Taylor type rule

$$r_t=r^*+\alpha_1(Y_t-Y_n)+\alpha_2(\Pi_{t-1}-\Pi_o) \qquad (5)$$

and a government behaving according to equation (4)

Substituting equation (1) in equations (2) and (5) we come up with the following system of first order difference equations:

$$(\Pi_t-\Pi_{t-1})=\beta(a-br_t+G_t-Y_n)$$
$$r_t=r^*+\alpha_1(a-br_t+G_t-Y_n)+\alpha_2(\Pi_{t-1}-\Pi_o)$$
$$G_t=G_{t-1}-\gamma(\Pi_{t-1}-\Pi_o)$$

By subtracting from the first equation of the system a lagged one, we obtain a single difference equation of the type

$$\Pi_t - 2\Pi_{t-1} + \Pi_{t-2} = -\beta b\,(r_t - r_{t-1}) + \beta(G_t - G_{t-1}) \qquad (6)$$

where the inflation path depends on the fiscal and monetary policy rules applied. Substituting both rules and after some simplifications we obtain

$$(1+b\alpha_1)\,\Pi t + (-2b\alpha_1 - 2 + \beta b\alpha_2 + \beta\gamma)\,\Pi_{t-1} + (b\alpha_1 + 1 - \beta b\alpha_2)\,\Pi_{t-2} = \beta\gamma\Pi_o \qquad (7)$$

In the steady state, or in other words, when current output is equal to potential one and, as a consequence, inflation is not accelerated, solving the equation (7) for the general case we will have that

$\Pi_t = \Pi_{t-1} = \bar{\Pi}$; $G_t = G_{t-1} = \bar{G}$; $r_t = \bar{r}$

and $\bar{\Pi} = \Pi_o$

This means that the inflation target desired by the economic authorities will be achieved, despite any shock that the economy could suffer, thanks to the performance of the fiscal and monetary policy rules. However, deepening in the analysis, if the inflation target that monetary and fiscal authorities estimate as the optimum one differs, then, the inflation objective chosen by the fiscal authority, which might be higher than the one proposed by the monetary one, will be imposed despite Central Bank independence. In fact, this is a quite real assumption if we consider that a higher rate of inflation may lighten the burden of the debt and could make it more sustainable. We can show this argument by changing the equations to include two different targets for the two policy rules:

$$r_t = r^* + \alpha_1(a - br_t + G_t - Y_n) + \alpha_2(\Pi_{t-1} - \Pi_{mo}) \qquad (8)$$

$$G_t = G_{t-1} - \gamma(\Pi_{t-1} - \Pi_{fo}) \qquad (9)$$

In this case the equation (7) will become

$$(1+b\alpha_1)\,\Pi t + (-2b\alpha_1 - 2 + \beta b\alpha_2 + \beta\gamma)\,\Pi_{t-1} + (b\alpha_1 + 1 - \beta b\alpha_2)\,\Pi_{t-2} = \beta\gamma\Pi_{fo} \qquad (10)$$

and the inflation target that the economy will reach is Π_{fo}

Moreover, we can calculate how far will be the reached inflation from the target followed by the Central Bank by subtracting the increase of inflation that the economy will experiment in period t from the situation in which the output will equal the potential one and r_t will be equal to r_n. It is important to notice that r_n is influence by G, The larger is G the higher will be r_n.

$(\Pi_t-\Pi_{t-1})=\beta(a-br_t+G_t-Y_n)$

$-(\Pi_t-\Pi_{t-1})=\beta(a-br_n+G_t-Y_n)$

given that when output is equal to potential the increase in inflation will be zero, we obtain

$$(1+b\alpha_1)\,\Pi_t+(-b\alpha_1-1+\beta b\alpha_2)\Pi_{t-1}=\beta b\alpha_2\Pi_{mo}+\beta b(r_n-r^*) \quad (11)$$

we can easily solve and obtain that

$$\overline{\Pi}=\Pi_{mo}+(r_n-r^*)/\alpha_2 \quad (12)$$

what means that, how far will be the reached inflation from the Central Bank objective will depend on the distance between the estimated r* and the r that will allow the economy to hit the potential output. In other words, Let's suppose that the current output in the economy is equal to the potential one in such a way that the inflation is stable and that its value coincide with the targets desired by both the Central Bank and the government. In such a situation, the Taylor rule will lead the Central Bank to establish r=r* and the fiscal rule applied by the government will stabilize the public expenditure in $G_t=G_{t-1}$. But let`s consider now that the government decides to increase the inflation target to $\Pi_{fo}>\Pi_o$. According to the fiscal rule, whether inflation will not equal the fiscal target, the government will step up the expenditure what implies a continuum augmentation of r_n, however the Central Bank will not change its estimation about r*, so the new r_n will not be introduced in the Taylor rule employed by the monetary authority. Moreover, every equilibrium interest rate introduced by Taylor rule will be too low in relation to the characteristic interest rate that will not accelerate inflation, thus the inflation reached in that economy when applying Taylor rule is higher that the desired one. As a consequence, while the inflation target of the Central Bank will not coincide with the one desired by the government, the performance of both a fiscal and a

monetary rule together will lead to an increase in inflation and the government objective will be imposed.

However, this failure in achieving the Central Bank target seems to be more related to the type of rule followed by the economic authority than to the kind of authority imposing the target. To prove this, let´s change the rules in the sense that the fiscal authority will follow a Taylor type of rule, in which there will be an estimated public expenditure G*.

$$G_t=G^*-\gamma_1(\Pi_t-\Pi_{t-1})-\gamma_2(\Pi_{t-1}-\Pi_0) \qquad (13)$$

By contrast, the Central Bank will use as a reference the real interest rate of the previous period and not an estimated one r*. In accordance with the previous setting, we will have the following system of first order difference equations:

$$(\Pi_t-\Pi_{t-1})=\beta(a-br_t+G_t-Y_n)$$
$$r_t=r_{t-1}+\alpha(\Pi_{t-1}-\Pi_o)$$
$$G_t=G^*-\gamma_1(\Pi_t-\Pi_{t-1})-\gamma_2(\Pi_{t-1}-\Pi_0)$$

Where G* will be the estimated public expenditure when current output is equal to the potential one.

In a similar way as before, in the steady state

$$\bar{\Pi}=\Pi_o$$

However, if we impose, as we did before, that the monetary and fiscal authorities have different interests in following different inflation targets, then the system will be modified as follows

$$r_t=r_{t-1}+\alpha(\Pi_{t-1}-\Pi_{mo})$$
$$G_t=G^*-\gamma_1(\Pi_t-\Pi_{t-1})-\gamma_2(\Pi_{t-1}-\Pi_{f0})$$

Given that G* only by chance will coincide with G_n, the inflation reached by the economy will depend on the distance between G* and G_n, according to the following

equation that is analogous to the previously obtained in (12) with the difference that now the economic authorities have switched the type of rule.

$$\bar{\Pi}=\Pi_{fo}+(G_n-G^*)/\gamma_2 \qquad (14)$$

As a last exercise we could try to calculate which one will be the inflation in the economy when both authorities are following the type of rule proposed for us where there is no estimated reference value for the Central Bank or the government and both authorities use the previous period value of the instrument considered. If both authorities have different inflation objectives we have

$$r_t=r_{t-1}+\alpha(\Pi_{t-1}-\Pi_{mo})$$
$$G_t=G_{t-1}-\gamma(\Pi_{t-1}-\Pi_{fo})$$

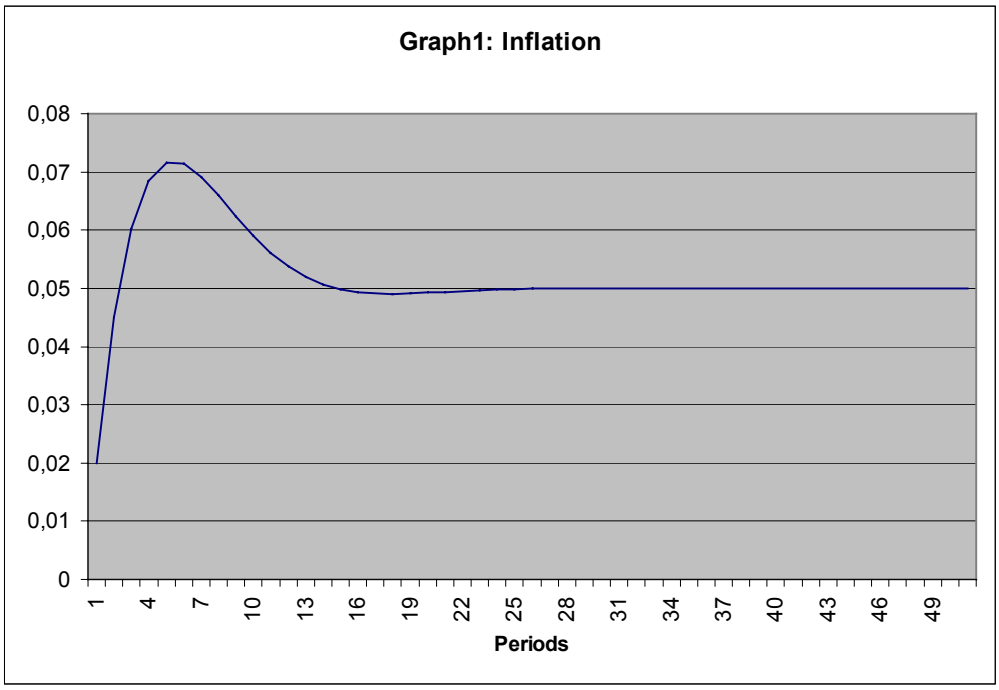
And solving the system, the equilibrium inflation in the economy will be a linear combination of the parameters and the targets of both authorities.

$$\bar{\Pi}=(b\alpha\Pi_{mo}+\gamma\Pi_{fo})/(b\alpha+\gamma) \qquad (15)$$

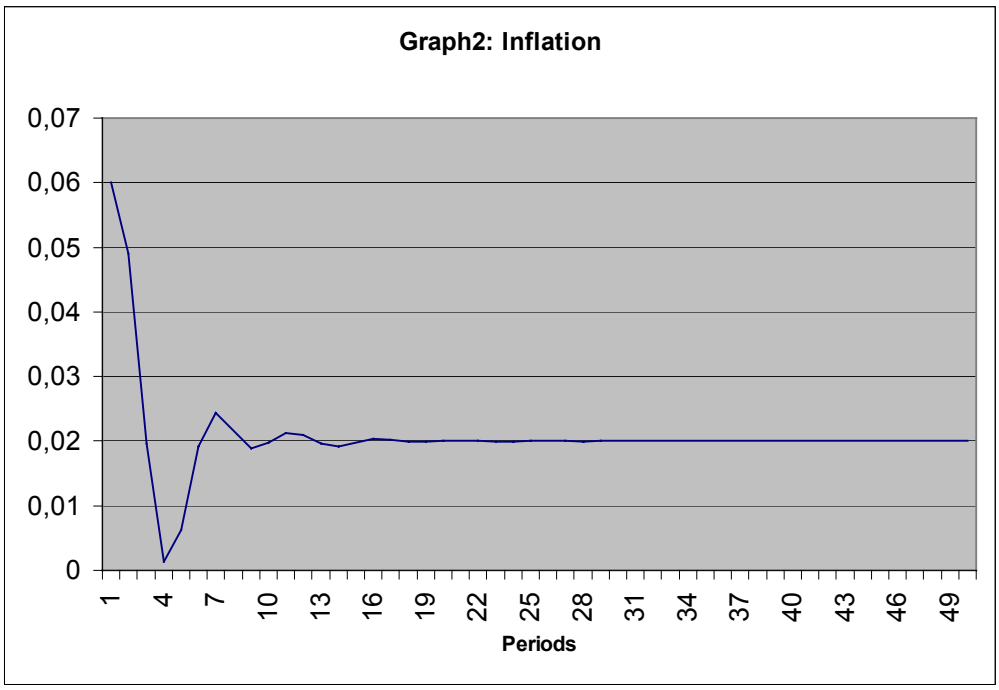
In this sense, we can conclude that an economic authority, the government or the Central Bank, will be able to impose an inflation target for the economy when the other authority is employing a Taylor type of rule, in the opposite case the inflation in the economy will be a combination of different targets weighted by the strength of both authorities when using their policy rules.

4. –Simulations

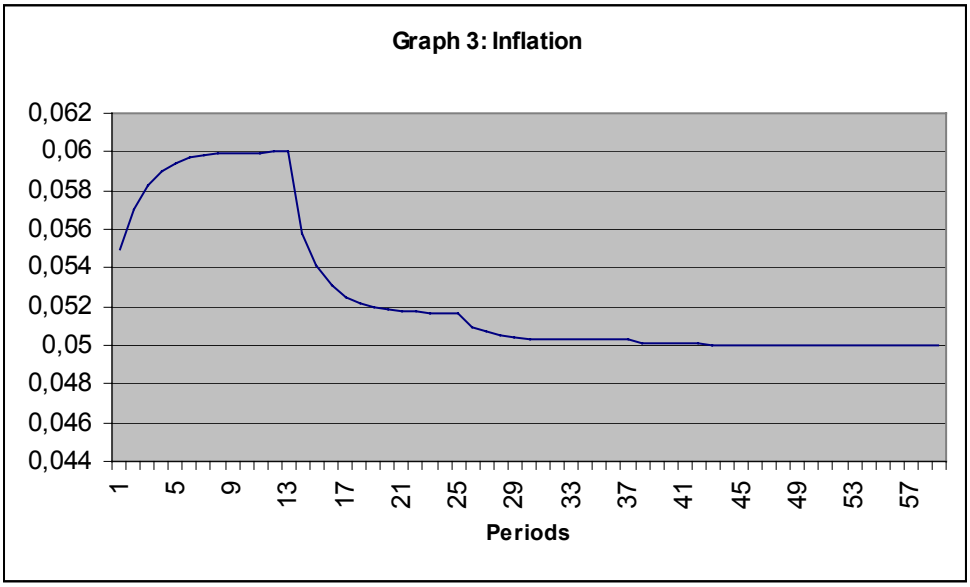
In order to complete the analysis, we have explored the empirical relevance of the type of rule applied by the economic authority through simulations techniques. We have reproduced the above described economy and we have supposed that the Central Bank is following a Taylor rule, similar to equation (5) and it has an inflation target of 2%. By contrast, we consider that the government is acting according to equation (4) and it has an inflation target of 4%. If the economy suffers a positive shock, as we can see in Graph 1, after some periods the policy rules will stabilize the economy at the government inflation objective value .



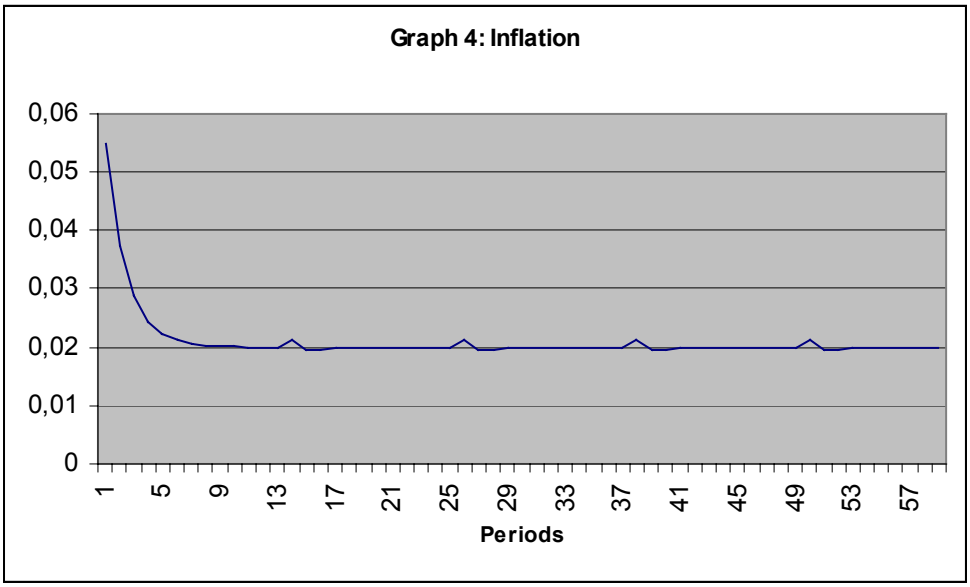
On the other hand, with the same inflation targets as before, if the government is following a policy rule similar to equation (13) and the Central Bank is acting according to equation (3) the equilibrium value for the inflation will be, instead of the 5%, the monetary authority target.



We are aware of the fact that the periods of implementation of fiscal and monetary policy are not the same and that, this fact could introduce some delays in the achievement of the inflation targets. However if we suppose that monetary policy performs monthly and that fiscal policy annually and we repeat the simulations exercises, the results will be the same except that this will introduce some delays in the stabilization process. Thus, graph 1 will turn into graph 3



In the same way, with different periods of implementation of both policies graph 2 will turn into graph 4, but again the inflation target achieved will not change.



5. –Conclusions

Since the equilibrium inflation is the result of a policy mix, Central Bank independence is not enough for imposing a given inflation target, in this sense, the type of rule that the monetary and fiscal authority follow in their performances is essential. The Taylor type of rule has a serious shortcoming due to the lack of inertia with the previous stage of the economy, thus we have proved that the economic authority that act according to it, will not be able to impose an inflation target. A direct implication of this argument is that when a Central Bank is not able to impose a given inflation target, the inflation objective could still be obtained through a fiscal policy rule.

On the other hand, most of the economic literature considers that the Central Bank employs rules similar to the Taylor type to conduct the monetary policy, however, giving that the fiscal authorities use their own policy rules, it will be necessary to review the utilization of Taylor's rule by the monetary authority taking into account that the monetary targets are usually achieved.

Although economic policy rules is a topic of enormous importance in the field of political economy, there is not much research dealing with the interaction between fiscal and monetary policy in terms of rules, therefore further research is needed. Possible extensions of this paper will be studying the interaction of both types of rules when there are others objectives involved apart from inflation.

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